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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/761,918	01/20/2004	Harry A. Atwater JR.	047071-0107	4108

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EXAMINER

DEO, DUY VU NGUYEN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 11/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/761,918	ATWATER ET AL.	
	Examiner	Art Unit	
	Duy-Vu N. Deo	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 8/11/06, 8/29/06.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 111-146 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 111-133 is/are allowed.
- 6) ☒ Claim(s) 134-146 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>8/11/06</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 111-146 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The limitation "treating a surface of ...to allow for a possibility of formation of a low resistance electrical contact between the device substrate and the handle substrate" is vague because it is not clear if low resistance electric contact between the two substrates are formed as a result of the treating step. Furthermore, the term "possibility" is vague and indefinite because it doesn't say whether or not the low resistance electric contact would be formed.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 134-138, 140-143, 145, 146 are rejected under 35 U.S.C. 102(e) as being anticipated by Kub et al. (US 6,323,108).

Kub describes a method for forming ultra-thin bonded semiconductor layers comprising: preparing or treating the surface of a substrate 10 having ultra-thin semiconductor layers (claimed device substrate) and a second substrate 18 (claimed handle substrate) (col. 3, line 10-20; col. 5, line 14-36; col. 6, line 1-15); bonding the two substrates to form a bonded interface (col. 6, line 23-25); removing a portion of the substrate 10 (device substrate) so as to leave ultra-thin semiconductor layers on the handle substrate 18 (col. 6, line 38-46). The treating of the two substrates to have desired chemistry such as hydrophobic surfaces for direct bonding and the post bonding anneal to strengthen a bond between the two substrates prior to performing the exfoliation anneal (col. 6, line 27-33) would provides covalent bonds or low resistance electrical contact between the two substrates (col. 6, line 6-9, 20-22; col. 7, line 50-52).

Referring to claims 135, 136, 141, the method includes hydrogen ion implanting into the substrate 10 prior to bonding, which would enable exfoliation of the ultra-thin semiconductor layers (or device film) from the substrate 10 and annealing the device after the bonding step (col.5, line 56-67; col. 6, line 39-45).

Referring to claim 137, the method further comprises cleaning the surfaces with plasma, UV ozone (col. 6, line 5-6).

Referring to claims 140, the method further comprises post bonding anneal to strengthen a bond between the two substrates prior to performing the exfoliation anneal (col. 6, line 27-33).

Referring to claims 143, the device film includes epitaxially growing group III-

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V materials and cap layers (claimed semiconductor layer) and the handling substrate includes Si (col. 5, line 8-46; col. 6, line 57-65).

Referring to claim 142 Kub suggests the desired surface chemistry for bonding includes hydrophobic surfaces (col. 6, line 9, 20-22; col. 7, line 50-52).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 139, 144 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kub as applied to claims 96, 99, 111, 114 above, and further in view of Gosele et al. (Fundamental Issues in Wafer Bonding, J. Vac. Sci. Technol. A 17(4) Jul/Aug 1999).

The resistivity of the bonded interface between the two substrates would depend on how they are prepared. Kub suggests the desired surface chemistry for bonding includes hydrophobic surfaces (col. 6, line 9, 20-22; col. 7, line 50-52), which at the time of the invention, are prepared by HF-dip as shown here by Gosele. This I-IF-dip creates hydrogen saturated silicon surfaces and removing any oxide layer (claimed passivating the surfaces of the two substrate to allow for hydrophobic bonding) (page 1145, second column, 3rd paragraph). This would provide claimed resistivity of 3.5 ohms cm² or less over a 0.1 cm² evaluation area in the bonded interface between the two substrates.

Allowable Subject Matter

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7. Claims 111-133 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action.

Claims 111-133 are allowable because the allowable subject matter of dependent claim 129 has been added into the independent claim 111.

Double Patenting

8. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

9. Claims 96-132 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 4-13, 19, 22-33 of copending Application No. 11/004,808 and over claims 19-38 of copending application 11/004948 in view of Gosele et al. (Fundamental Issues in Wafer Bonding, J. Vac. Sci. Technol. A 17(4) Jul/Aug 1999).

Claims cited above from the two copending applications describes a method for forming a virtual substrate including steps of ion implanting the device substrate, bonding the device and handle substrates, and removing the device substrate to leave a device film on the handle substrate. Claims from the two-copending applications do not suggest the step of treating the surfaces of the two substrates to allow for formation of covalent bonding or low resistance electrical contact. However, this step is well known to one skilled in the art as shown here by Gosele (page 1145, second column, 3rd paragraph). One skilled in the art would find it obvious to prepare the substrates in light of Gosele by treating the two substrates because it is a necessary step to prepare and clean the substrate for the bonding as taught by Gosele.

This is a provisional obviousness-type double patenting rejection.

Terminal Disclaimer

10. The terminal disclaimer filed on 8/11/06 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of U.S. Patent 7,019,339 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Response to Arguments

11. Applicant's argument that the bonded interface in Kub is not necessarily or inherently ohmic is found unpersuasive because there are no facts to back up applicant's arguments. Furthermore, as pointed out by applicant that the pre-bonding baking or annealing step eliminates the absorbed water from the bonded surface, which

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contributes to the ohmic interface. Kub also shows a post bonding anneal to strengthen the bond (col. 6, line 27-33). This annealing would eliminate water from the bonded surface. Therefore, the bonded interface would have ohmic characteristic.

Referring to applicant's about step (1) prepares the surface for the future formation of the low resistance electric contact, this is not in the claim. The claim clearly states that "treating a surface of at least one of a device substrate and a handle substrate to allow for a possibility of formation of a low resistance electrical contact between the device substrate and the handle substrate". Furthermore, the term "possibility" is vague and indefinite because it doesn't say whether or not the low resistance electric contact would be formed.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Duy-Vu N. Deo whose telephone number is 571-272-1462. The examiner can normally be reached on Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Duy-Vu N Deo
Primary Examiner
Art Unit 1765

11/2/06

